AN APPRAISAL OF THE TRADITIONAL FISH HANDLING AND PROCESSING METHODS IN LAKE CHAD.

AHMED, T. MARYAM and AGBELEGE, O. OLUSEGUN
Federal College of Freshwater Fisheries Technology, Baga,
P.M.B. 1060, Maiduguri, Borno State. Nigeria.

Abstract
This paper reviews the various techniques of fish handling and processing in Lake Chad.
Poor handling of fish catches on board coupled with the distant location of the fishing grounds and thick aquatic vegetation on the lake which hamper fast movement of catches to the processing centers are the bane of good quality fresh fish getting to the processors.
The techniques adopted in processing and preservation are mainly smoking, char-burning and sun drying. Defects suffered by the processed products of the methods include high moisture content, heavy insect infestation, bacterial decomposition and fungal attack. Protection of catches from direct sunlight by spreading wet jute s over them will lower the rate of deterioration. Removal of the aquatic vegetation by appropriate authorities and canalization will ease movement of fish catches to the processing centers. More serious enlightenment of the processors on the adoption of the 'Chorkor' oven will reduce the problems presently facing cured fish. The use of *rambo* insecticide and other dangerous chemicals by the fish processors and marketers for the preservation of fish products before repackaging should be discouraged.

Key Words: Techniques, fish handling, processing, insecticides, Lake Chad.
Paper presented at the 22nd Annual Conference of the Fisheries Society of Nigeria (FISON), held at Birni Kebbi, Kebbi State. Nigeria, from 12th 16th November, 2007.

Introduction

Fish constitutes an important component of many Nigerian dishes with a projection of an annual consumption rate at about 2.35 million metric tones (Okpanefe, 1982). Fish is preferred as it supplies essential nutrients which are lacking in other diets and its consumption is not forbidden within religious groups, unlike the eating of dog and pork which are forbidden in Islam (Agbelege and Ipinjolu, 2001). As the human population in Nigeria is ever increasing, less fish will be available per caput annually (Eyo, 1992). Unfortunately, larger proportion of this valuable commodity is wasted. It has been estimated by FAO (1994) that post harvest loses remain at about 25% of the total world catch annually.

Processing methods generally in practice in Nigeria are traditional and consist of sun drying, salted and sun drying , smoke drying, scorching before sun drying that is *banda* (Tobor 1969, 1984, Azeza, 1976). Tobor (1984) listed the composition of the different methods of fish disposal in the artisanal sector as follows:

Live fish	7%
Fresh but chilled	27%
Smoked dried	45%
Sun dried	15%
Salted and sun dried	4%
Others (e.g. fried)	2%

Source: Tobor (1984)

Neiland (1987, 1991) reported that traditional fish processing methods including smoking char burning and sun drying and high post harvest losses persist at Lake Chad.

The value of fish as a source of animal protein makes it imperative for fish to be properly processed and well preserved so that it will get to the final consumer in acceptable nature (Eyo, 1983).

The main objective of fish paper therefore is to assess the current traditional fish handling and processing methods with associated defects of the cured fish in Lake Chad and advance suggestions for the improvement of the methods to minimize the problems.

Background Information on Lake Chad.

Lake Chad lies between latitude 12° N 14° 20' N and longitude 13° 15° 30' E south of Sahara within the Sahel zone of West Central Africa. It is a very large shallow eutrophic lake shared by four West African countries Chad 50%, Nigeria 25%, Niger 17% and Cameroon 8%. The shoreline of the Nigerian portion of the lake which is characterized by numerous islands extends for about 256kms from the mouth of River Yobe at Malamfatori in the north to the mouth of the El-Beid at Wulgo in the south. The surface area of the lake is not constant as it has been fluctuating between 6,000km2 (Bukar and Gubio, 1985; LCBC, 1989; FAO, 1990). The maximum depth of the lake recorded in the Cameroonian sector is about eight meters (Sagua, 1993).

Fishing practices adopted in the lake are mainly at artisanal level using labour intensive fishing gears such as the traditional traps, spears and hooks (Agbelege et al., 2003). With the introduction of gill nets in the early sixties, commercial exploitation started (Neiland *et al.*, 1999). Blache (1964) observed 140 species; Hopson (1967) observed 88 species with the commercially important species like *Lates*, *Citharinus*, *Hydrocynus* and *Tilapia* dominating the catches. The reduction in species composition is one of the devastating effects of the 1972/73 and 1983/84 drought, when the major inflowing rivers failed to flow and the northern basin dried up as in 1907-1908 (LCBC, 1989). In the post drought era of 1972/73 and 1983/84, Bukar and Gubio (1985) observed 19 species while Nwoko *et al.* (1991) observed 17 species with *Clarias* and Tilapia dominating. Neiland *et al.* (1994) also observed 16 species while Agbelege *et al.* (2003) observed 29 species with *Clarias* and *Tilapia* dominating.

Fish production from the lake increased from 15,000 MT (1960) up to 220, 000 MT by 1974 (Sagua, 1986). The production dropped to 50,000 MT/year (Neiland *et al.*, 1996). However, information on the current status of the fisheries of the lake has been very limited (Jolley and Neiland, 1998).

Fish Handling

Fresh fish handling procedures encompass all the operations aimed at maintaining food safety and quality characteristics from the time fish is caught until it is consumed. In practice, it means reducing the spoilage rate as much as possible, preventing contamination with undesirable microorganisms, substances and foreign bodies and avoiding physical damage of edible parts (Huss, 1995).

Azeza (1976) and Eyo (1988, 2001) observed that fishermen lose a good proportion of their catches due to poor handling of the fish while in fresh state. The fish catch are usually kept on the floor of the boat in a pool of warm dirty water and worse still the fish may be stepped upon by the fishermen and their children forcing out the viscera which further hasten deterioration. Eyo (1988) noted that the fish are not stunned rather they are left to struggle and die of asphyxia which makes rigor mortis to set in fast at death. The rigor period is usually within few hours depending on the species, size and death type. The rigor period is of short duration in a struggling fish due to the gradual depletion of glycogen and the inability of the dying fish to re-synthesize adenosine-tryphosphate (ATP) which invigorates the muscles. Bacteria growth is retarded during rigor mortis and the fish freshness can be prolonged. Therefore it becomes necessary to do everything which will allow a long rigor period.

In Lake Chad, most of the fishing grounds are located far away from the middle men/fishmongers and the processing centers coupled with the thick aquatic vegetation, the fishermen are engaged in arduous task in moving their catches to the processing centers. Such fish are liable to go into spoilage before the commencement of processing which leads to poor quality of the final product (Eyo, 1999).

Protecting the catches from direct sunlight by covering them with wet jute bags will keep the fish in a more wholesome state than freely exposing them to the sun. Eyo, (1999) also recommended wet wooden boxes for the transportation of the catches from the fishing grounds.

Fish Processing

Various traditional methods are employed in preserving and processing fish for consumption as well

as storage. These are smoking, sun-drying, salting, frying and fermentation as well as combinations of these. In Lake Chad, smoking is the most widely practiced method (Azeza, 1976; Eyo, 1988; Osuji, 1976; Clucas, 1982; Adjetey, 1962).

Smoking

Smoking is the one of the oldest and most common methods used for fish preservation in the Lake Chad basin. The smoking kilns are of different types and shapes. Some are either rectangular or cylindrical in shape and made of mud or metal (oil drum). The "Chorkor" smoking kiln is receiving very positive attention from Government. The smoking kiln even though modest can smoke large quantities of fish at a time (Shimang, 1992). The "Chorkor" oven, named after a small fishing hamlet on the outskirts of Accra, has other numerous distinct advantages over other kilns. The pit oven is used but uncommon.

Fish smoking in Lake Chad is undertaken at the traditional level by women in the fishing islands. The main economic activity of women in the fishing settlements is fish processing. Depending on the of fish to be smoked, its uses and the period it may have to be stored, the smoking process can take the form of "wet" hot smoking or "dry" hot smoking. Both processes are carried out at temperatures above 80^0 C which are high enough to cook the fish (Eyo, 2001; Clucas and Sucliff, 1981; Moses, 1983).

Before smoking commences, large size fish such as *Lates niloticus* and *Gymnarchus niloticus* are cleansed and cut into chunks while the medium sized fish are curled round so that the tail reaches the head and then skewered into a pointed stick while in the smaller ones, the tail is fixed in the fish's own pectoral spine (Eyo, 2001). The very smaller fish *Clarias albopunctatus* (popularly called *dimka*) are smoked whole (*dogodogo*) (Agbelege, 2000). After the preparations the fish are laid on mats or dry grass for a little sun-drying. The fish are then laid on the wire gauze in the ovens and fired from below (Eyo, 2001). Smoking period varies from 2-4 days which is determined by the amount of fuel firewood available and the size of the fish. After smoking the fish, are packed in cartons ready for the market.

Banda

The *banda* is also a popular name for smoked fish by char-burning in Lake Chad (Durand, 1980). After preparation, the fish are placed on dry grasses and covered with another layer of dry grasses which are set on fire after which the fish are left in the sun for further drying (Azeza, 1982, 1986).

Salanga

In the Lake Chad basin sun-drying of smaller fish species such as *Alestes* and *Tilapia* are done directly under the scotching desertic sun. The fish are either sun-dried whole or split open ventrally and laid on mats to dry (Durand, 1980; Welcomme, 1985). Some larger oily fish species like *Clarias* which have started deteriorating are split open and treated with dangerous chemicals like *rambo* and *gammalin 20* to keep away blow flies (Eyo, 1999).

Problems associated with the fish and fish products

The invasion of the lake by aquatic vegetation after the drought of 1972/73 and 1984/85 and its erratic hydrological cycle have made easy movement of the fishermen and their catches to the processing centers very difficult. The fishermen are faced with the arduous task of transporting their catches fast to the processing centers (Agbelege, 2007; Eyo, 1988). Fish designated for processing centers go into spoilage before arrival. This leads to post-harvest loss in term of nutritive value (Eyo, 2001).

Most of the present smoking ovens used by the processors are very laborious and they produce poor quality smoked fish of low capacity and inefficient smoking process. This usually lead to high post-harvest loses and use of more fuel-wood than necessary. The health of the women smokers are also at risk (Anon., 1971). Fish are not also uniformly smoked but case hardened (Eyo, 2001) and most time when the fish are left under the sun to complete the drying process, blow flies lay eggs on the fish which develop into maggots which penetrate the partially dried flesh of the fish causing serious post-harvest lose and low market value (Azeza, 1982; Eyo, 1989; Eyo, 2001). The damage done by the larvae of blow flies is irreversible.

Other pests commonly found on cured fish are *Necrobia rufipes* and *Dermestes spp*. The larvae and adults of *Necrobia rufipes* and *Dermestes spp* cause quantitative loss of dried fish they feed upon. Their feeding also leads to fragmentation and quality losses due to contamination by insect bodies and cast skins. The extent and value of losses due to *Necrobia rufipes* infesting dried fish is directly to the length of storage of the fish. Where infestation involves both *Dermestes* and *Necrobia rufipes*, the later is usually in the minority but its contribution to the total beetle damage may be enormous (Osuji, 1975; Haines and Rees, 1989). The extent and value of quantitative losses caused to dried fish by *Dermestes spp* have been assessed by various authors such as Azeza (1976); Osuji (1975, 1977) and estimates range from neglible up to 50%

weight loss depending on length of storage, salt content, moisture content, climatic conditions and general hygiene during processing and storage (FAO, 1981). Agbelege (2000) observed the use of insecticides such as *rambo* and gammalin 20 at the Doro fish market for the treatment of fish against insect infestation. The chemicals are mixed with vegetable oil and or palm oil with water in a basin. The mixture is then sprinkled on the fish before repackaging in cartons for designated destinations.

Conclusion and Recommendations

Lake Chad is still a big fishery and one of the most productive in the world. It remains a source of livelihood to the communities within and outside its immediate region of location. The benefits derived from the lake are at stake as aquatic vegetation has taken over a larger portion of the northern basin. The Lake Chad Basin Commission should wake up to the challenge of restoring the lake to normalcy through the riparian countries. Most of the smoking kilns presently in use are very labourious and they produce poor quality smoked fish, therefore efforts should still be intensified on the adoption of the Chorkor oven in the processing centers due to its enormous advantages.

Government through their health authorities should promulgate laws or edicts banning the use of killer chemicals used during packaging and repackaging of cured fish instead let the chemical industries manufacture non-lethal chemicals which can be used for the preservation of processed fish against insect infestations.

References

Adjetey, J.N.N. (1962). Improving the traditional method of smoking. *FAO Fish Res. Report No. 1.*

Agbelege O.O. (2007). Constraints associated with fishing activities in Lake Chad. *A paper presented at the 22nd Annual Conference of the Fisheries Society of Nigeria (FISON)*, held at Birnin Kebbi State. Nigeria from 12th -16th Nov. 2007.

Agbelege, O.O. (2000). *A study of the fisheries of the Nigerian portion of Lake Chad.* Post Graduate Diploma Project Report. Department of Forestry and Fisheries, Usmanu Danfodiyo University, Sokoto. 121p.

Agbelege, O.O. and J.K. Ipinjolu (2001). An assessment of the exploitation and the management techniques of the fisheries resources in the Nigerian portion of Lake Chad. *Journal of Arid Zone Fisheries* Vol. 1: pp89-98.

Agbelege, O.O., Raji, A. and M.M. Mofio (2003). Fishing gear survey of Lake Chad. In: A.A. Eyo and E.A. Ajao (eds). *Proceedings of the 16th Annual Conference of the Fisheries Society of Nigeria (FISON).* Maiduguri 4th 9th November 2001 pp87 98

Anon. (1971). Equipment and methods for improved smokedrying of fish in the Tropics. *FAO Fish. Tech. Pap. No. 104.*

Azeza, N.I. (1976). Fish handling, processing and marketing in the Lake Chad Basin (North West Shores). In: *Proceedings of the conference on the handling, processing and marketing of tropical fish. Tropical Products Institute, UK.* pp 348-352.

Azeza, N.I. (1982). Quality assessment in processed fish from Lake Chad for southern markets. FAO expert consultation of fish technology in Africa. *FAO Fisheries Report No. 268.* pp75-83.

Azeza, N.I. (1986). The problem of choice of safer methods of reducing post-harvest losses in Lake Chad processed fish. In: *Fish processing in Africa. Proceedings of the FAO expert consultation on fish technology in Africa*, Lusaka, Zambia, Jan. 1985, FAO Rome. Pp340-349. FAO Fish Report No. 329 (Suppl.) 747p.

Blache, J. (1964). Les poison du basin du Tchad et du basin adjacent du Mayo kebi. *Mem CPSTOM, 4, 6, 11,* 483p.

Bukar, T.A. and A.K. Gubio (1985). The decline of the commercially important species of fish and predominance of *Clarias lazera* in Lake Chad. In: *Proceedings of the 4th Annual Conference of the Fisheries Society of Nigeria (FISON).* Port-Harcourt 26th-29th November, 1985. pp35-41.

Clucas, I.J. and Sucliff, P.J. (1981). *An Introduction to fish handling and processing.* TPI 56/62 Gray's Inn Rd. London. WCI 8LU ODA.

Clucas, J.I. (1982). Fish handling, preservation and processing in the topics. Part 2. *Report of the Tropical Development and Research Institutes*, G145.

Durand, J.R. (1980). Evolution des capture totales (1962-1977) et devenir des pecheries de la region du lac Tchad. *Cahiers ORSTOM series Hydrobiologie* 13(1-2), 93-111.

Eyo, A. A. (1992). Utilization of freshwater fish species in Nigeria. In: *Proceedings of the 10th annual*

conference of the fisheries society of Nigeria (FISON). A.A. Eyo and A.M. Balogun (eds). pp 32-37.

Eyo, A.A. (1988). An appraisal of the traditional fish handling and processing in Kainji Lake area, *NIFFR*. New Bussa, Kwara State.

Eyo, A.A. (1989). Artisanal fish handling, preservation and processing in Nigeria- problems and prospects. *Proceedings of the National Conference on two decades of research on Lake Kainji*. Ayeni J.S.D. and Olatunde A.A. (eds). pp167-178.

Eyo, A.A. (1999). Fish processing and marketing in the arid zone of Nigeria with particular reference to Lake Chad area. In: *Lake Chad and Arid Zone Fisheries*. A.A. Olatunde and J.S.O. Ayeni (eds). National Institute for Freshwater Fisheries New Bussa Nigeria. pp172-175.

Eyo, A.A. (2001). *Fish Processing Technology in the Tropics*. University of Ilorin Press. 403p

FAO (1981). The prevention of losses in cured fish. *FAO Fish Tech. Pap.* (219): 87p.

FAO. (1994). Review of the state of world marine fisheries resources. *FAO Fish. Tech. Pap.* 335p.

Haines, C.P. and Rees, D.P. (1989). A field guide to the types of insects and mites infesting cured fish. *FAO Fisheries Technical Paper. No. 303*. FAO, Rome, 1989. 33p.

Hopson, A.J. (1967). Fisheries of Lake Chad. In: *Fish and Fisheries of Northern Nigeria*. The Ministry of Agriculture, Northern Nigeria, Kaduna, Nigeria. pp188-201.

Huss, H.H. (1995). Quality and quality changes in fresh fish. *FAO Fish. Tech. Pap. 348*. FAO Rome.

Jolley, T. H. and Neiland, A.E. (1998) Changes in the fish stock composition of the wetlands of the Lake Chad Basin 1960-1996: a multi-disciplinary analysis. *CEMARE Misc. publ. No.42*. 13p.

LCBC. (1989). Lake Chad Basin Commission 25th Anniversary Brochure, *LCBC Secretariat* N'djamena.

Moses, B.S. (1983) *Introduction to Tropical Fisheries*. Ibadan University Press, University of Ibadan, Ibadan, Nigeria and UNESCO/ICU Paris. 117p.

Neiland, A., S.P. Madakan, B.M.B. Ladu, and M-T. Sarch (1999). A profile of the Arid zone fisheries of Northeast Nigeria based on 1993/94 survey results at Lake Chad, the Upper River Benue and the Nguru-Gashua wetlands. In: A.N. Okaeme, A.A. Olatunde and J.S.O. Ayeni. (eds). *Lake Chad and Arid zone Fisheries*. National Institute for Freshwater Fisheries Research, New Bussa, Nigeria. 202p.

Neiland, A.E. (1987). Lake Chad is still a big fishery. In: *Fishing News International*. 26(1): 40-41.

Neiland, A,E. (1991). An overview of fisheries research in the Chad Basin of Africa 1920-1988: including a partially annotated bibliography. *CEMARE Res. Pap. No. 45*, (IV) 79p.

Neiland, A.E. Sarch, M.T. Madakan, S.P. and B. Ladu (1996) Fisheries research priorities for international inland waters in West and Central Africa: a case study of the Chad Basin. *CEMARE Res. Pap. No. 93*. 15p.

Neiland, A.E. Weeks, A.J. Madakan, S.P. and B.M.B. Ladu (1994). Traditional fisheries jurisdiction in N.E. Nigeria: results of a survey at Lake Chad, the Upper River Benue and the Nguru-Gashua Wetlands. *CEMARE Research Paper No. 72*. Portsmouth: University of Portsmouth, Centre for the Economics and Management of Aquatic Resources.

Nwoko, C.U. Umeham, S.N. and B.C. Azionu (1991). Changes in the limnology and water resources of Lake Chad. *The effects of aridity and drought in arid zone hydrology and water resources* .N.M. Gadzama *et al.* (eds) p441-449.

Okpanefe, M. O. (1982). Demand analysis for Nigerian fisheries. In: *Proceedings of the 2nd Annual Conference of the Fisheries Society of Nigeria (FISON)* pp193-200.

Osuji, F.N.C. (1975). Recent studies on the infestation of dried fish in Nigeria by *Dermestes maculates* and *Necrobia rufipes* with special reference on Lake Chad district. *Trop. Stored Prod. Inf.*, 29: 21-32.

Osuji, F.N.C. (1976). The influence of traditional handling methods on the quality of processed fish in Nigeria. In: *Proceedings of the conference on the handling, processing and marketing of tropical fish. Tropical Products Institute*, UK. pp319-322.

Osuji, F.N.C. (1977). The development of *Necrobia rufipes* in dried fish and certain other commodities. *Nigerian Journal of Science*, 15:21-32.

Sagua, V.O. (1986). Review of the evolution of the fisheries of Lake Chad, 1980-1985. *Committee for Inland Fisheries of Africa*. CIFA/PD: S/86/3.

Sagua, V.O. (1991). The current status of the fisheries resources of the Lake Chad Basin and a programme for its management and conservation. In: *Management strategies for inland fisheries in the Sahel. FAO fisheries Report, No. 445*. p42 53.

Shimang, G. N. (1992). Post-harvest losses in inland fisheries in Nigeria with emphasis on Lake Chad and

Kainji. In: Proceedings of the Symposium on Post-Harvest Fish Technology Cairo, Egypt. F. Teuctscher (ed). *CIFA. Tech. Pap.* CPCA 19.

Tobor, J.G. (1984). A review of the fishing industry in Nigeria and status of fish preservation methods and future growth prerequisites to cope with anticipated increase in production. *NIOMR. Tech. Pap. No. 17.*

Tobor, J.G. (1969). Notes on the traditional methods of fish preservation in the Nigerian sector of Lake Chad. *Fed. Fish. Occa. Pap. No 14*

Welcomme, R.L. (1985). River Fisheries. *FAO Fish. 1985 Tech. Pap.*, (262): 330p.